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Managing Diabetes in the under 5's Paediatric Diabetes Webinar

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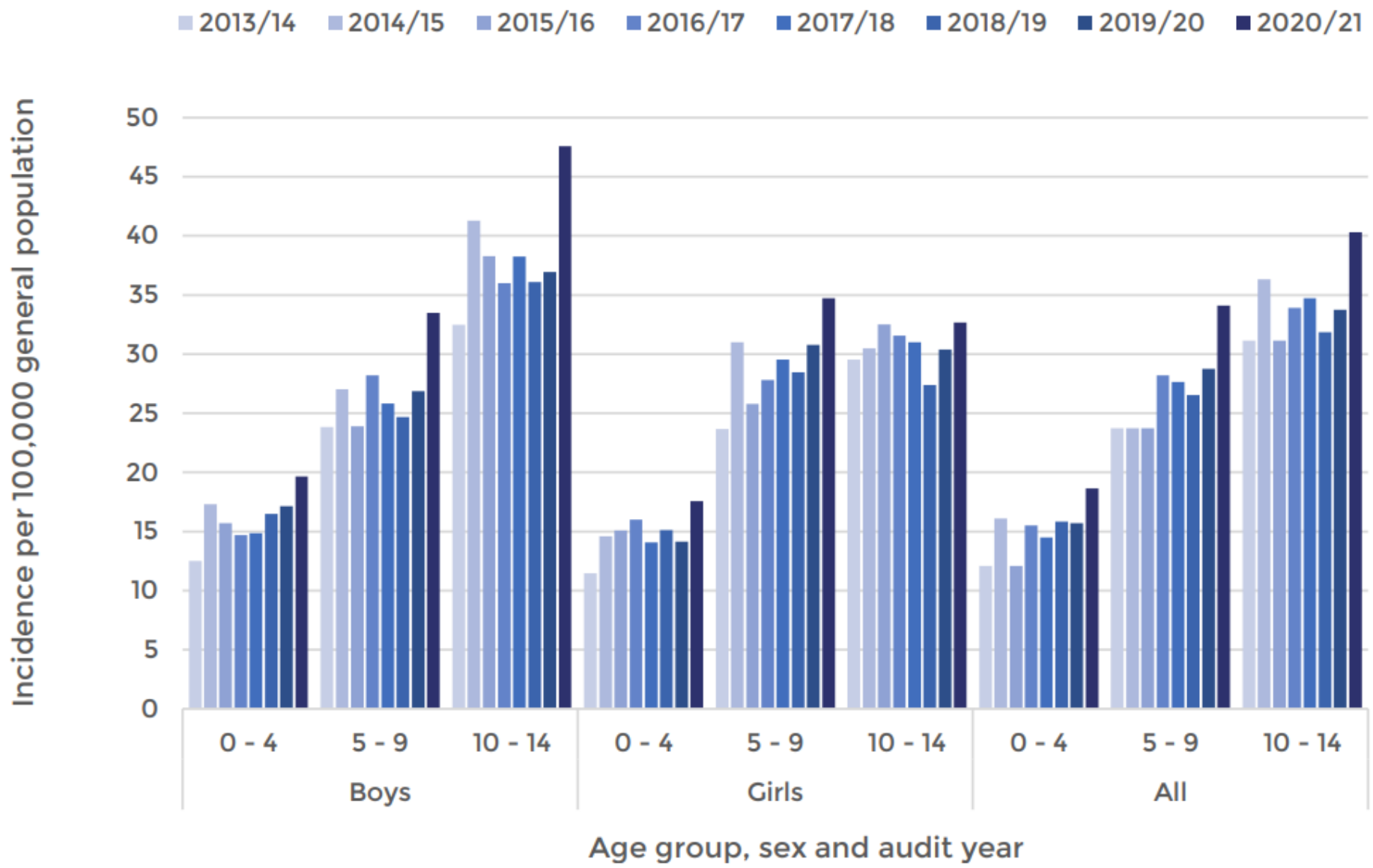
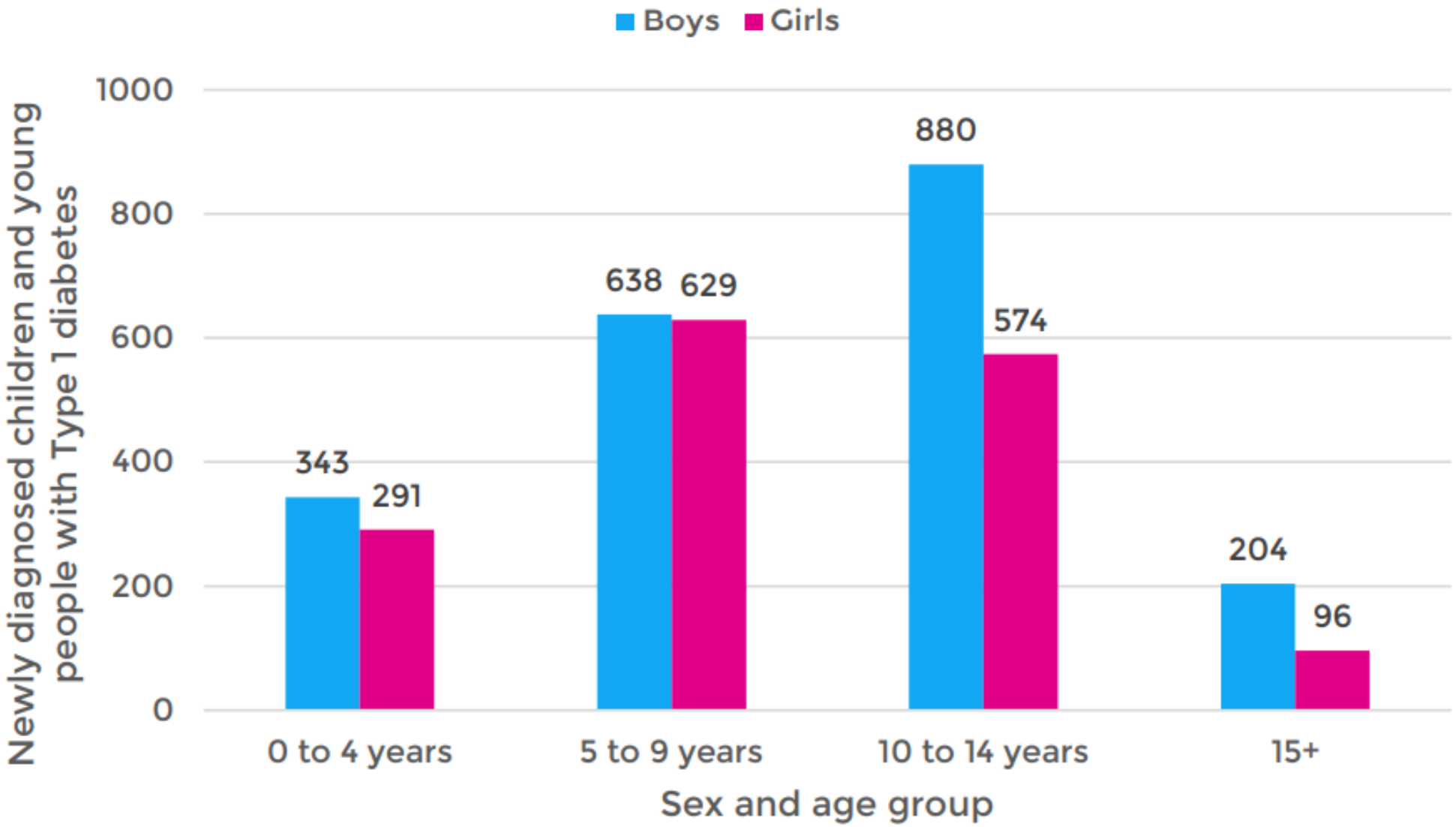
Content

- Incidence
- Targets
- Age Specific challenges
- Insulin
  - Delivery methods
  - Dosage
  - Ratios
  - Increments
- Meal management
- Pump choices/ systems in relation to young children
- Hypoglycaemia treatment

Significant increase in T1DM in each group (NPDA Annual Report 20/21)



Newly diagnosed diabetes in CYP by age group and sex (NPDA Annual Report 20/21)



Received: 6 August 2016 | Revised: 14 May 2017 | Accepted: 31 May 2017
DOI: 10.1111/pedi.12554

ISPAD GUIDELINES

WILEY ISPAD

Managing diabetes in preschool children

Frida Sundberg[1,2] | Katharine Barnard[3] | Allison Cato[4] | Carine de Beaufort[5,6] | Linda A DiMeglio[7] | Greg Dooley[8] | Tamara Hershey[9,10] | Jeff Hitchcock[11] | Vandana Jain[12] | Jill Weissberg-Benchell[13,14] | Birgit Rami-Merhar[15] | Carmel E Smart[16] | Ragnar Hanas[2,17]

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DOI: 10.1111/pedi.12644

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ORIGINAL ARTICLE

Young children with type 1 diabetes can achieve glycemic targets without hypoglycemia: Results of a novel intensive diabetes management program

Helen Phelan[1,2] | Bruce King[1,3,4] | Donald Anderson[1,3,4] | Patricia Crock[1,3,4] | Prudence Lopez[1,3,4] | Carmel Smart[1,3,4]

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- The target HbA1c for all children with type 1 diabetes, including preschool children, is recommended to be <7.5% /<58 mmol/mol (ISPAD 2017)
- An HbA1c target level of 48 mmol/mol (6.5%) or lower will minimise the risk of long-term complications (NICE 2022)

  Agree an individualised lowest achievable HbA1c target with each CYP. Take into account factors such as their daily activities, individual life goals, complications, comorbidities and the risk of hypoglycaemia (NICE 2022)

  CYP can achieve target glycemia without an increase in severe hypoglycaemia or DKA (Phelan et al 2017)

Age specific challenges in young children

- Dependent on others for all aspects of care
- Small insulin requirements
- Common food issues:
  - Variable appetite
  - Transient food preferences
  - Food refusal
- Unpredictable physical activity
- Growing rapidly
- Hypoglycaemia
- Recognising hypoglycaemia

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Parental fear of hypoglycaemia

Published in final edited form as:
Pediatr Diabetes. 2018 February ; 19(1): 114–120. doi:10.1111/pedi.12525.

Nighttime is the Worst Time: Parental Fear of Hypoglycemia in Young Children with Type 1 Diabetes (T1D)

Michelle A. Van Name, MD[1], Marisa E. Hilliard, PhD[3], Claire T. Boyle, MS[2], Kellee M. Miller, PhD[2], Daniel J. DeSalvo, MD[3], Barbara J. Anderson, PhD[3], Lori M. Laffel, MD, MPH[4], Stephanie E. Woerner, FNP[5], Linda A. DiMeglio, MD, MPH[5], and William V. Tamborlane, MD[1]

- Fear of hypoglycaemia common in parents
- Especially common in parents of young children because
  - Young children unable to recognise symptoms
  - Limited ability to communicate symptoms
- Strategies that parents might use
  - Night time testing - Found to be performed by most families with preschool children (ISPAD 2017)
  - Aim for higher glucose levels to avoid hypoglycaemia
- Clinical interventions
  - Continuous glucose monitoring (CGM)
  - HCL systems
  - Use of alarms + Interface with other devices – e.g. parent phones

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Insulin Requirements in Young Children
(ISPAD 2017)

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- Preschool children with optimal glycaemic control need less insulin than older children
- TDD reported as 0.4 to 0.8 U/kg/d (median 0.6 U/kg/d)
- Basal can be 20 - 40% of TDD

  CHO ratios
  - Insulin to carbohydrate ratio (ICR) represents how many grams of carbohydrate are matched by 1 unit of rapid acting insulin e.g. 1:20 grams CHO
  - 500 rule (500/TDD = how many grams of CHO is covered by 1 U of insulin) often not sufficient insulin
  - Preschool children often need proportionally larger bolus doses than older children

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Insulin Increments

1.0 units increments	0.5 units increments	0.05 unit increments	0.025 unit increments	0.01 unit increments	Other
Humalog KwikPen	Humapen Luxura HD	Omnipod DASH (0-30 U/hr)	MiniMed 640 System	Ypsopump 0.01 U/hr at programmed rates 0.05 U/h to 1.00 U/h (0-40U/hr)	Tandem T-slim 0.001 units at programmed rates ≥ 0.1 units/hr 0.01 unit (at rates >0.05 units)
FlexPen	NovoPen Echo				
Autopen					
SoloSTAR/ JuniorSTAR					

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Why use pumps in the under 5's

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ISPAD GUIDELINES

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Managing diabetes in preschool children

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- During toddler and preschool years, the brain is highly sensitive to metabolic disturbances, such as long term exposure to hyperglycaemia as well as hypoglycaemia (especially with seizures)
- Optimizing glycaemic control for preschool children is crucial for both long term diabetes complications as well as their neurocognition, brain structure & health-related quality of life
- Insulin pumps offer greater flexibility in insulin dosing and deliver very small, precise doses of insulin

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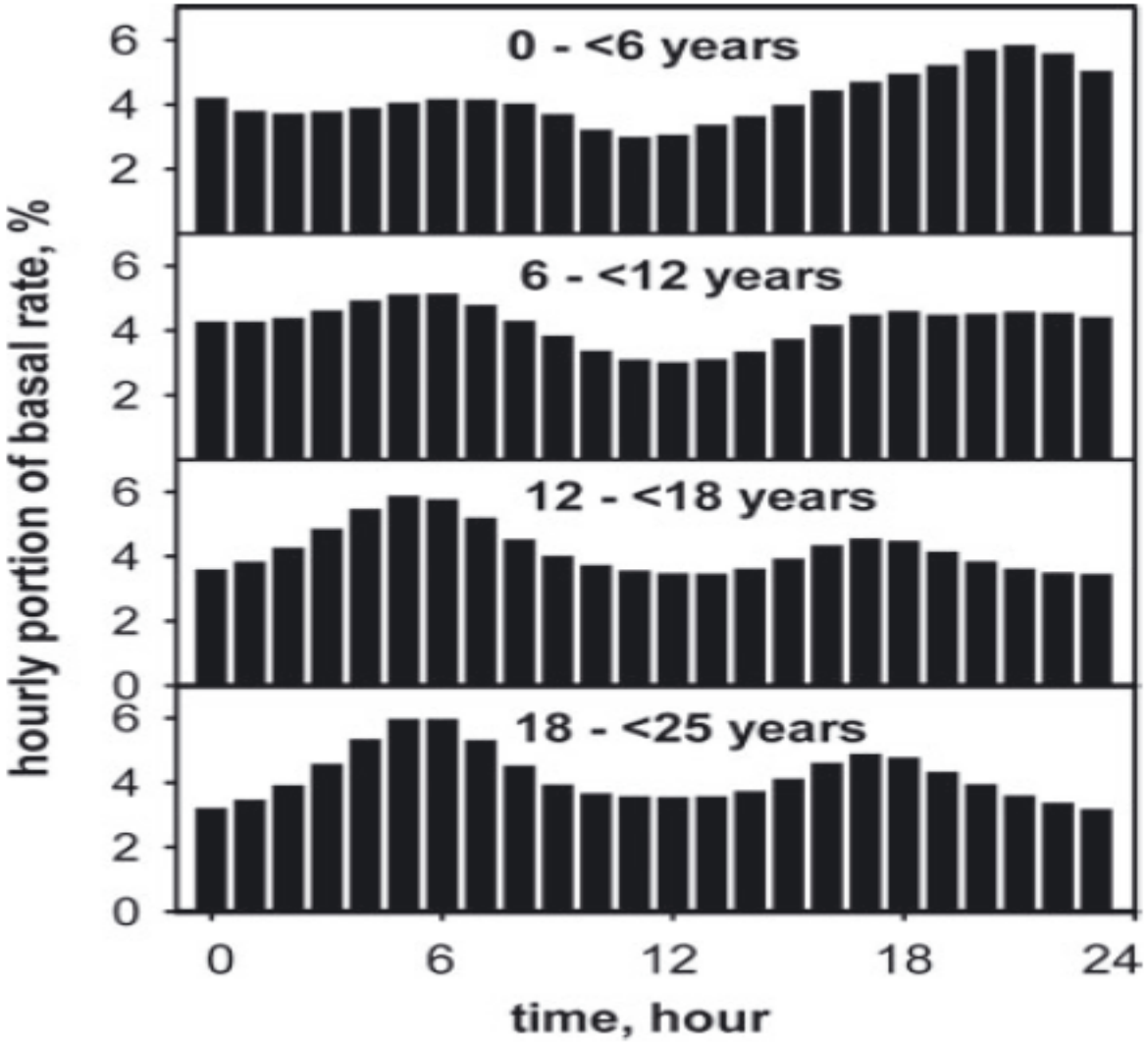


Fig. 1. Circadian distribution of basal insulin in four age groups (% of daily insulin requirement).

Basal rates & circadian profiles according to age

Bachran et al (2011)

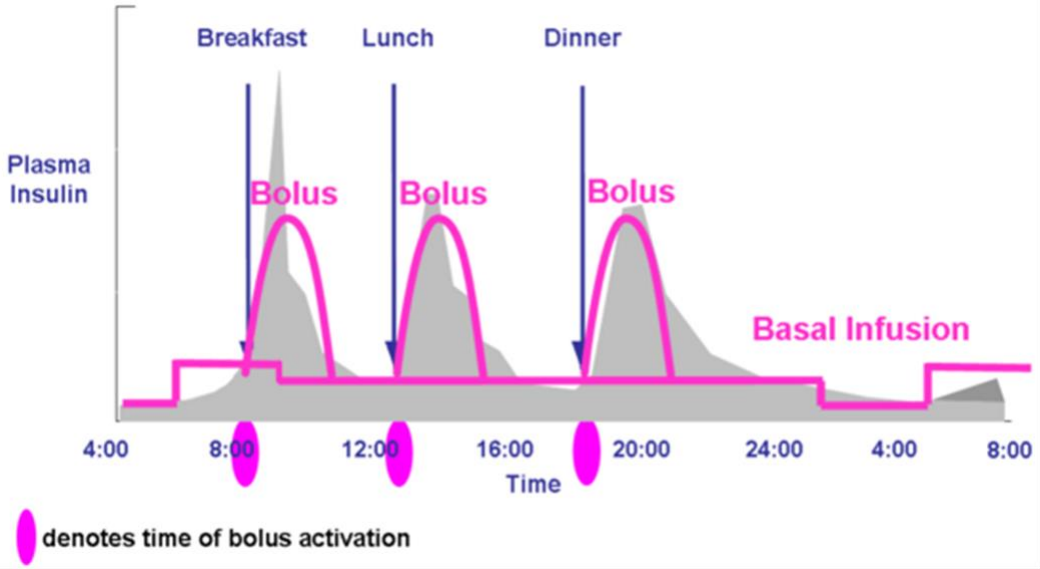
- Age of the patient is the primary factor that influences both TDD and circadian distribution of basal insulin in CSII
- Low basal rate reflecting high insulin sensitivity at lunchtime in all groups
- In preschool group:
  - High basal requirement between 19.00-22.00 in preschool group
  - Small peak between 05:00-08:00
  - Mean basal requirement 0.3 units/kg

Pump settings – UCLH Basal Calculation

- Calculate total daily dose (TDD)
- 30% of this to be given as basal
- Basal % divided by 24
- This gives you a 100% amount/per hour

- 4 time blocks

  00.00-07.00 80% of hourly rate
  07.00-10.00 130% of hourly rate
  10.00-19.00* 100% of hourly rate
  19.00-24.00 120% of hourly



Large breakfast bolus may necessitate a low or suspended basal during the morning

* 10.00-12.00 zero basal

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Insulin ratio calculation (UCLH)

- The ratios will be initially calculated by age
- To calculate TDD at diagnosis use 0.5 units/kg/day
- Use the same rules if doing a ‘reset’
- Correction ratio or insulin sensitivity factor (ISF) the same across all age groups

	Under 5 years	Aged 5-12 years	Over 12 years
Breakfast	150	200	300
Midday meal	250	250	350
Evening meal	250	250	350
ISF/ Correction factor	130	130	130

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Use of Continuous Glucose Monitoring (rtCGM)

- Offer rtCGM to all CYP with T1DM, alongside education to support its use (NICE 2022)
- Options to connect to mobile phones/ cloud
  - Enables ‘following’ and remote monitoring
  - Gives reassurance in terms of other carers e.g. nursery/ family members
- Using rtCGM has provided new opportunities for families aiding decision making
  - Glucose Value
  - Direction/speed of travel
- Part of Hybrid Closed Loop Systems

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Hybrid Closed loop Systems

- Closed-loop automated insulin delivery systems, which combine an insulin pump with a CGM and a predictive algorithm that adjusts insulin delivery in real-time, have been shown to improve glycaemic control in CYP + adults with T1D without increasing the risk of hypoglycaemia (Weisman A, Bai JW, Cardinez M, et al.: Effect of artificial pancreas systems on glycaemic control in patients with type 1 diabetes: a systematic review and meta-analysis of outpatient randomised controlled trials. Lancet Diabetes Endocrinol 2017;5:501–512)

- Age/ weight requirements for current system licences:
  - Tandem + Dexcom G6 (using control IQ) – 6 years + weight 24kg + 10 units TDD
  - Medtronic 640 + Enlite/Guardian 3 sensors – no age restriction
  - Medtronic 670 + Guardian 3 sensors (automode) – 7 years + 8 units TDD
  - Medtronic 780 + Guardian 4 sensors (using SmartGuard) – 7 years and 8 units TDD
  - CamAPSfx – using Dana pump, Dexcom G6, android phone and subscription to APP – 1+ yrs (Dexcom licensed 2 yrs) + weight 10kg + 5 units TDD

DIABETES TECHNOLOGY & THERAPEUTICS
Volume 23, Number 5, 2021
Mary Ann Liebert, Inc.
DOI: 10.1089/dia.2020.0507

DTT

ORIGINAL ARTICLE

Safety and Performance of the Tandem t:slim X2 with Control-IQ Automated Insulin Delivery System in Toddlers and Preschoolers

Laya Ekhlaspour, MD,[1,2,*] Melissa J. Schoelwer, MD,[3,4,*] Gregory P. Forlenza, MD,[5] Mark D. DeBoer, MD,[3,4] Lisa Norlander, MD,[1] Liana Hsu, BS,[1] Ryan Kingman, BS,[1] Emily Boranian, BS, RN,[5] Cari Berget, RN, MPH, CDCES,[5] Emma Emory, RN,[3] Bruce A. Buckingham, MD,[1,2] Marc D. Breton, PhD,[3] and R. Paul Wadwa, MD[5]

- Short Pilot study using 12 children aged 2-5 years
- Meals and snacks not restricted + min 30 mins of exercise/day
- Study used a modified version of Control-IQ, which removed the weight variable and lowered the total daily insulin lower limit to 5 U/day
- No modification to the algorithm itself
- Control-IQ improved glycaemic control by increasing TIR without increasing hypoglycaemia

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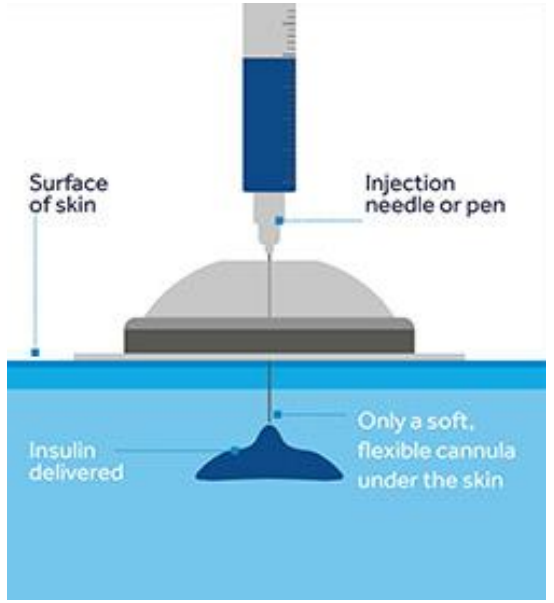
Choice of cannula in young children

- Significantly less SC fat – need shorter or angled cannula
- Tubing needs to be longer if pump worn in back pack
- Teflon needles kink easily
- Importance of site rotation to reduce likelihood of lipohypertrophy, scarring, infection, rashes, skin reaction and dry skin

Indwelling catheters

- If pump therapy not available, MDI with consideration of using a port should be used (ISPAD Guidelines 2017)
- Indwelling catheters
  - Once the port is applied, the needle of syringe or pen goes through the port
  - Can help with injection anxiety, injection problems and pain of repeated injections
  - Average indwelling time is 3-5 d
  - Example - i-Port Advance - Needles need to be 5-8mm (3/16-5/16”) in length and 32-28 gauge/ max 75 insertions



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Meal management

- CHO counting at diagnosis
- Importance of routines
- Limited snacking/grazing
- Use of dual wave/ split bolus dosages to managing difficult eating behaviour
- Advising good eating behaviour has impact on outcomes, along with structure and routines

Treatment of Glucose level outside of target

- Recommendation of 0.3g glucose/kg bodyweight for treatment of mild hypoglycaemia (ISPAD 2017)
- This dose will raise plasma glucose 2.5-3.6 mmols/L
- 5-7 g CHO usually adequate to raise plasma glucose to normal in small children

- BG <3.6mmol/L requires hypoglycaemia treatment
  - <2 years – 3-5 grams CHO
  - <5 years – 5 grams CHO
  - <10 years – 10 grams

	5g	10g
Lucozade orange	60ml	120ml
Lucozade energy tablets	2 (6g)	3 (9g)
Dextrosol	2 (6g)	3 (9g)
Gluco tabs	1 (4g)	2 or 3
Jelly sweets (average)	4g	8g
Apple juice*	50ml	100ml
Glucojuice	20ml	40ml

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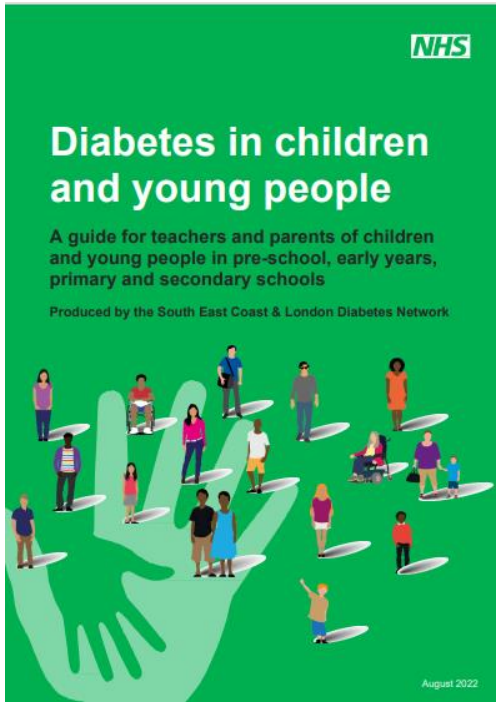
Pre schools & Nurseries

- Optimal glycaemic control minimizing hypo and hyperglycaemia to give the child the best opportunity to concentrate, participate and learn
- Working together with families to ensure the toddler is supported
  - Recommend 1:1 support
  - SEC and London ‘Diabetes in Children and Young People’ Document (2022)



- Education/ Support provided to staff
  - Higher level of anxiety - allowing food if high; alarms from CGM
- Diabetes management plan
  - Practical training on use of technology
  - CHO counting
  - Videos to support/reinforce training

Useful reference papers

- Adolfsson, P, Ziegler, R, Hanas, R. Continuous subcutaneous insulin infusion: Special needs for children. Pediatr Diabetes. 2017;18:255–261. https://doi.org/10.1111/pedi.12491
- Bachran R, Beyer P, Klinkert C, et al. Basal rates and circadian profiles in continuous subcutaneous insulin infusion (CSII) differ for preschool children, prepubertal children, adolescents and young adults. Pediatr Diabetes. 2012;13(1):1-5. doi:10.1111/j.1399-5448.2011.00777.x
- Sundberg, F, Barnard, K, Cato, A, de Beaufort, C, DiMeglio, LA, Dooley, G, Hershey, T, Hitchcock, J, Jain, V, Weissberg-Benchell, J, Rami-Merhar, B, Smart, CE, Hanas, R. Managing diabetes in preschool children. Pediatr Diabetes. 2017; 18: 493– 497. https://doi.org/10.1111/pedi.12554

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